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Pathological Spectrum of Nephrectomies in a General Hospital

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OBJECTIVES: To first categorize a series of nephrectomies according to underlying pathology, as practised in a major general hospital in the north of Jordan, and then compare the results with published figures for Western countries. Also, to create standards for future evaluation of nephrectomies performed by laparoscopy.

METHODS: The hospital and pathological records of 423 consecutive nephrectomies performed at Princess Basma Teaching Hospital in the north of Jordan during the period of 1991–2000 were reviewed.

RESULTS: Benign disease led to surgery in 298 cases, of which 161 were secondary to infection-related conditions. Malignancy resulted in the removal of 125 kidneys. The rate of nephrectomy for benign conditions has declined during the last few years in comparison with that for malignant conditions. Patients operated on for benign diseases were younger (mean age, 38.4 years) than those with malignant tumours (mean age, 46.7 years).

CONCLUSIONS: The mean age of patients undergoing surgery for benign and malignant disease was lower than in publications from Western countries. The frequency of nephrectomy performed for tuberculosis, hydatid disease, and xanthogranulomatous pyelonephritis is still higher than the rates published in Western countries. There is a remarkably low frequency of upper urothelial carcinoma compared with Western countries, probably due to environmental differences and genetic susceptibilities. Malignant renal tumours tend to affect people at a remarkably young age in Jordan, which is thought to be a reflection of the high proportion of young people. Nephrectomy for malignant disease had a higher rate of complications (16.8%) than for benign conditions (9.4%; $p < 0.0228$). The re-operation rate was 3.1% for all patients who underwent nephrectomy. The overall 30-day mortality rate was 0.9%. Both screening and education programmes are needed to decrease the rate of nephrectomy for preventable conditions. (*Asian J Surg* 2002;25(2):163–9)

Introduction

Nephrectomy is a common procedure in surgical practice. Simple nephrectomy is indicated in patients with an irreversibly damaged kidney resulting from symptomatic chronic infections, obstruction, calculus disease or severe traumatic injury. It is, occasionally, appropriate to remove a functioning kidney that is associated with one of these conditions when the patient's age or general condition is too poor to permit a reconstructive operation, provided that the opposite kidney is normal.

Nephrectomy may also be indicated to treat renovascular hypertension from non-correctable renal artery disease, or for severe unilateral parenchymal damage resulting from nephrosclerosis, pyelonephritis, reflux dysplasia, or congenital dysplasia. Although radical nephrectomy is standard treatment for localized renal cell carcinoma with a normal contralateral kidney, there is growing interest in the use of nephron-sparing surgery for select patients.

This review of 423 conventional nephrectomies carried out in one hospital in Jordan may be considered as a

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model for Middle Eastern countries because the demographic, racial, and economic features of these populations are comparable. The purpose of the study was to gain reliable information about indications, morbidity, and mortality in order to set standards for comparison with publications from Western countries. Also, we aimed to create result-based intrahospital standards for future evaluation of nephrectomies performed using minimally invasive techniques. The long period covered by this study enabled us to compare present and past indications for nephrectomy in Jordan.

Patients and Methods

A retrospective study was done on 431 consecutive nephrectomies performed at Princess Basma Teaching Hospital in Jordan during the period January 1991 to December 2000. Eight nephrectomy patients were not included in the study because their records were not found in the archives, leaving 423 records available for analysis. Data were collected from the hospital's medical records and the single pathology centre serving the area. We obtained data regarding the following points: age at presentation, gender, symptomatology, smoking habits, laboratory investigations and imaging studies. These were matched with the histopathology results.

The indications for nephrectomy were divided into malignant and benign conditions. The first group was subdivided into renal cell carcinomas (RCC), urothelial carcinomas, nephroblastomas and other malignant tumours. The benign group was subdivided into benign tumours, infectious-related and non-infectious-related conditions. Criteria for infection were defined as preoperative pyuria, preoperative identification of infected material, or histologically proven acute or chronic infection. Another subgroup was classified as miscellaneous, consisting of nephrectomies for anomalies, trauma, or rejected kidney transplant.

The χ^2 test was used for statistical analysis. A p value of less than 0.05 was considered statistically significant.

Results

The number of nephrectomies studied was 423, of which 238 were in males (56.3%) and 185 in females (43.7%). The male-to-female ratio was 1.29:1. A malignant tumour was the indication for nephrectomy in 125 cases (29.6%), whereas 298 kidneys (70.4%) were removed due to benign conditions (Table 1).

RCC was found in 91 kidneys (72.8%) with malignant tumours; three of them were removed secondary to recurrence from a contralateral primary kidney tumour. Six (4.8%) of the malignant tumours were urothelial carcinomas. Nephroblastoma was found in 21 children (16.8%). The other seven malignant tumours consisted of one case each of primary squamous cell carcinoma, rhabdomyosarcoma, and renal invasion by a retroperitoneal sarcoma, two cases with invasion by an adrenal carcinoma, and two cases of metastasis (breast and lung).

Of the benign kidneys, 161 (54%) were removed due to infection-related conditions associated with end-stage renal diseases: chronic pyelonephritis was detected in 117 cases, xanthogranulomatous pyelonephritis in 13 cases, pyonephrosis in 17 cases, tuberculosis in nine cases, hydatid cysts in four cases, and one case with emphysematous pyelonephritis. Renal stones were seen in 44 cases with chronic pyelonephritis, 11 cases with xanthogranulomatous pyelonephritis, four cases with tuberculosis and in 14 cases with pyelonephrosis. The reasons for nephrectomy in the non-infected group were severely decreased kidney function in 29 patients and renal hypertension in five patients. In our study, 73 cases were classified as miscellaneous conditions consisting of congenital anomalies, trauma, and rejected kidney transplants in 44, 22, and seven patients, respectively. Trauma led to 12 complete nephrectomies and 10 partial nephrectomies. Additional trauma patients were not included in the study because they underwent simple kidney repair only.

During the last few years, nephrectomy for benign conditions declined compared with malignant conditions. In the first 5-year period of the last decade (1991–95), 158 operations were performed for benign conditions compared with 140 in the last period (1996–2000) ($p < 0.05$) (Table 2).

Malignant tumours were significantly predominant in males ($p < 0.0001$), while benign conditions were slightly higher in females. Most of the malignant tumours occurred on the left side. No side difference was found in the benign groups. The mean age of patients with nephrectomy for benign conditions was 38.4 years (range, 0.4–90 years), while that for malignant diseases was 46.7 years (range, 0.25–80 years).

The majority of malignant renal tumours were removed using a transabdominal approach.

Table 1. Diagnosis and age distribution in 423 nephrectomies

Diagnosis	Number of patients (%)	Male: female ratio	Mean age, years (range)
Malignant disease			
Total	125 (29.6)	2.9:1	46.7 (0.25–80)
Renal cell carcinoma	91 (21.5)	3.8:1	55.7 (7–80)
Urothelial carcinoma	6 (1.4)	2:1	62.0 (45–75)
Nephroblastoma	21 (5.0)	1.3:1	2.2 (0.25–5)
Other malignancies	7 (1.7)	2.5:1	50.2 (39–62)
Benign disease			
Total	298 (70.4)	1: 1.1	38.4 (0.4–90)
Benign tumours	30 (7.1)	1: 1.7	42.4 (6–71)
Infectious conditions	161 (38.1)	1: 1.4	42.8 (6–90)
Noninfectious conditions	34 (8.0)	1.4: 1	41.3 (8–63)
Miscellaneous	73 (17.2)	1.9: 1	25.8 (0.4–57)
Total	423	1.29: 1	

Table 2. Change in the 5-year incidence of nephrectomy for malignant disease and benign conditions

	Benign conditions	Malignant conditions
1991–1995	158	53
1996–2000	140	72

Odds ratio = 1.5; p value using χ^2 for 2 X 2 table < 0.05.

Thoracoabdominal access was used in four cases of RCC. Retroperitoneal access was mainly used for simple nephrectomy in benign conditions, and for nephroureterectomy in patients with urothelial carcinomas.

Postoperative Complications, Re-operations and Mortality

Postoperative complications occurred in 49 patients (11.6%) (Table 3). Complications were significantly higher in the malignant group (16.8%) than in the benign group (9.4%; $p < 0.0228$). Pneumonia and haemorrhagic complications were more frequent in the RCC group than the other groups. Gastrointestinal (GI) complications were particularly more frequent in the malignant group than the other groups, with a highly statistically significant difference ($p < 0.01$). There was no statistically significant difference in the rate of wound infection between the two main groups ($p < 0.10$).

Thirteen patients (3.1%) were re-operated on for complications: six patients (1.4%) for wound complications, three (0.7%) for GI complications, three (0.7%) for haemorrhagic complications, and one (0.2%) for a missed swab. Re-operations for bleeding after nephrectomy were done on one patient with left RCC and one with right nephroblastoma; the bleeding occurred from the suprarenal arteries in both. Bleeding from the lumbar vessels after a nephrectomy for an infection-related condition caused the third case. Ileus was the reason for GI re-operation secondary to adhesions after transabdominal operations in two patients with RCC and for retroperitoneal sarcoma in the third. Six wound infections had to be treated surgically; four of them following surgery for infection-related conditions, one after a post-traumatic partial nephrectomy, and the last following RCC. Four patients had drainage for retroperitoneal abscesses, while two patients had debridement of infected wounds.

Table 3. Postoperative complications in 423 nephrectomies

Diagnosis/complication	Haemorrhage	Gastrointestinal complications	Wound infection	Pneumonia	AMI	Others	Total (%)
Malignant disease (*n* = 125)							
Renal cell carcinoma (*n* = 91)	2	4	2	3	1	2	14 (15.4%)
Urothelial (*n* = 6)	0	1	0	0	0	0	1 (16.7%)
Nephroblastomas (*n* = 21)	1	2	0	0	0	0	3 (14.3%)
Other malignancies (*n* = 7)	0	1	1	0	0	1	3 (42.9%)
Benign disease (*n* = 298)							
Benign tumours (*n* = 30)	0	1	1	0	0	1	3 (10.0%)
Infectious conditions (*n* = 161)	1	1	8	1	1	1	13 (8.1%)
Noninfectious conditions (*n* = 34)	1	1	2	0	0	1	5 (14.7%)
Miscellaneous (*n* = 73)	0	1	3	1	1	1	7 (9.6%)
Total	5	12	17	5	3	7	49 (11.6%)

The "Others" column includes deep vein thrombosis, pulmonary embolism and cerebrovascular incidents. AMI = acute myocardial infarction.

Four patients (0.9%) died within the postoperative period (< 30 days). Two died of advanced cancer, and two of acute myocardial infarction (AMI) and pulmonary infarction after surgery for benign conditions. There were no statistically significant differences in mortality between the benign and the malignant groups of patients.

Discussion

The results of this study enable us to pathologically classify the indications for nephrectomy in Jordan, and perhaps other countries of similar socio-demographic structures in the Middle East, for comparison with figures in the West.

In 1966, Scott and Selzman described a rate of 29% for neoplasia,[1] while Schiff and Glazier presented a neoplasia rate of 38% a decade later.[2] Beisland et al presented a historical 20-year series of 646 consecutive nephrectomies with a 61% neoplasia rate in Norway.[3] In all of these series, nephroureterectomies for urothelial carcinomas were excluded. Excluding urothelial carcinoma in the current study, we had a 28.5% neoplasia rate. There was no significant increase in the incidence of malignant tumours. The relative increase in the malignancy rate, therefore, must be due to the considerable decrease in nephrectomy for benign conditions, and the increase in the number of people referred to our hospital. There are likely to be several reasons for this: better management of urinary tract infections, better control of hypertension, and improvement in the management of renal stones by minimal or non-invasive techniques (lithotripsy, percutaneous nephrolithotomy). In addition, with better understanding by physicians of the pathophysiology of obstructive uropathy and the necessity for immediate treatment and, thereby, the risk for serious functional damage to the kidney, the frequency of nephrectomy has been reduced.

Muscat et al found that the mean age for incidence of RCC in men was 58.7 years, while it was 59.3 years in women.[4] Bretheau et al from France reported the mean age for RCC as 62.1 years, with a male-to-female ratio of 2:1.[5] In Norway, Beisland et al reported that the mean age of the patients with RCC was 64.3 years (range, 15–90 years).[3] In their series, patients operated on for benign conditions were younger (mean age, 51.8 years) than those with all types of malignant tumours of the kidney (mean, 65.4 years).

In our study, patients operated on for benign conditions were younger (mean age, 38.4 years) than those with malignant tumours (mean, 46.7 years), the oldest being

patients with urothelial carcinomas (mean, 62 years). These figures are much lower than published ages in other countries. This is largely because 50% of the Jordanian people are below the age of 16 years (1996 census). The youngest patient with renal adenocarcinoma was a 7-year-old child who was diagnosed after being investigated for post-traumatic haematuria. RCC is an uncommon tumour of childhood as it comprises only 2.3% to 6.6% of renal tumours in children,[6–8] while Wilm's tumour constitutes 85% to 87%.[9,10] The present report shows that the mean age of patients with RCC is 55.7 years, which is still lower than those in the aforementioned Western series. However, other cancers such as breast cancer affect patients at a remarkably young age in the Middle East.[11]

Nephron-sparing surgery appears to be a safe and effective alternative to radical nephrectomy for localized small renal tumours.[12–14] Nine of our patients had this type of surgery: three for small adenocarcinomas in solitary kidneys, and six for small tumours of less than 5 cm; four of them proved to be adenocarcinoma and the other two were oncocytoma.

There were 30 (7.1%) patients with benign tumours, with a male-to-female ratio of 1: 1.7. In Norway, Beisland et al reported 10 cases (1.6%) out of 646 nephrectomies with a male-to-female ratio of 1:4.[3] There are relatively few updated reports in the literature on the epidemiology of benign renal tumours.

In different studies, renal pelvis tumours accounted for approximately 10% of all renal tumours and about 5% of all urothelial tumours.[15] Ureteral tumours are even more uncommon, occurring with one-quarter the incidence of renal pelvis tumours.[16] Beisland et al reported 98 cases of urothelial tumours, making up 15.2% of all the nephrectomies presented and accounting for approximately 22.4% of all renal tumours.[3] We found only six cases of upper urothelial tumours for which nephroureterectomies were performed, accounting for 4.8% of all the renal tumours in our study. This remarkably low frequency of upper urothelial carcinoma perhaps reflects environmental differences from other areas and possibly different genetic susceptibility. It is well known that upper tract urothelial carcinoma has a higher incidence in families afflicted with Balkan endemic nephropathy.[17] This nephropathy may affect many people living in the same house, but the pattern of its genetic transmission or susceptibility, if one exists, is not clear.[18] As a result, family members who leave home at an early age may not be affected, whereas those who join the family may contract the illness.

In one report of 161 patients with end-stage renal disease, 42 patients (26%) had "chronic pyelonephritis" with bacteriuria in the past or at the time they were studied.[19] However, a complicating factor was involved in all of the 42 patients with chronic pyelonephritis and end-stage renal diseases: 66.7% had vesicoureteral reflux (VUR); 14.3%, analgesic abuse; 11.9%, nephrolithiasis; 4.8%, pyelonephritis during pregnancy; and 2.4%, hydronephrosis. In our study, several complicating factors were involved in most patients with nephrectomy due to infection-related conditions (Table 4). Nephrolithiasis was the commonest factor in our series, being confirmed in 73 patients (45.3%). However, renal stones are very common in this particular region of Mediterranean countries.[20,21] Other factors, like reflux nephropathy, ureteropelvic junction obstruction, and pyelonephritis during pregnancy were found in 43 (26.7%), 18 (11.2%), and 16 (9.9%) cases of infection-related nephrectomy, respectively.

We found 13 patients with xanthogranulomatous pyelonephritis, accounting for 8.1% of all patients with renal inflammation who were evaluated pathologically. This figure is higher than those published in previous reports (0.6%–1.4%).[22,23] Eleven of these patients were female, with a mean age of 50 years (range, 23–65 years),

Table 4. Complicating factors in patients undergoing nephrectomy for infection-related conditions (*n* = 161)

Complicating factor	Number	%
Nephrolithiasis	73	45.3
Reflux nephropathy	43	26.7
Ureteropelvic junction obstruction	18	11.2
Pyelonephritis during pregnancy	14	8.7
Unknown	13	8.1

and three patients (23.1 %) were diabetic.

Beisland et al, found that five (0.8%) tuberculous kidneys were removed out of 646 nephrectomies carried out during 20 years at two Norwegian hospitals.[3] We found nine (2.1%) tuberculous kidneys that were severely diseased, and nephrectomy after efficient chemotherapy was mandatory in each case. However, Wong and Lau reported that 89.3% of all tuberculous nonfunctioning kidneys had been destroyed and required nephrectomy; in only three out of 28 cases was reconstruction possible.[24] Kerr and co-workers recommended the removal of diseased organs.[25]

Isolated renal hydatid cyst is an uncommon presentation of echinococcal disease, since renal involvement occurs in only 2%–3% of cases.[26,27] We found five cases of renal hydatid disease; only the four with nephrectomy were included in the study, with cystectomy being performed for the last case.

The higher rate of nephrectomy for infected kidneys in females is not surprising, as women are more prone to urinary tract infections than men. Other benign conditions have approximately equal distribution between males and females. However, miscellaneous conditions are approximately twice as common in males than females, as trauma is more frequent in males. We found a significantly higher rate of pneumonia in the malignant group compared to nephrectomy for other conditions. Out of the five patients who developed pneumomia postoperatively, three had undergone transabdominal surgery for RCC, and four of these patients were above the age of 55 years. However, the choice of surgical approach did not lead to significant differences in postoperative complications, re-operations, or mortality (Table 5). Thoracoabdominal access was ignored in the analysis because of the small number of cases. The transabdominal approach may increase the risk for GI complications. Schiff and Glazier reported a lower incidence of complications when using an anterior retroperitoneal approach,[2] while Scott and Selzman found that the transperitoneal approach gave a lower complication rate.[1] Swanson and Borges reported 19.1% postoperative complications using midline incisions for renal carcinomas.[28] Beisland et al reported a 15.5% rate of postoperative complications using different surgical approaches.[3] They also found a significantly higher rate of postoperative complications for malignant disease (17.6%) than for benign conditions (11.0%). Similarly, in our study, nephrectomy for malignant disease had a significantly higher rate of complications (16.8%) than operations for benign conditions (9.4%; $p < 0.0228$). Our figures may be considered satisfactory, which is probably because the mean age of our patients is lower than those in publications from other countries and, thus, more fit for anaesthesia and surgery.

Beisland et al reported a re-operation rate after nephrectomy of 3.0% for all the conditions, while it was 1.5% for bleeding after radical nephrectomy for localized RCC (pT1–pT2).[3] The present study showed a re-operation rate of 3.1% for all the patients who underwent nephrectomy, while it was 1.1% for bleeding after radical nephrectomy for localized RCC.

The overall 30-day mortality within the RCC group was 2.0%. Beisland et al had an approximately 3.4% mortality rate within this group.[3] In the present series, the mortality rate of 0.7% after nephrectomy for benign disease was significantly lower than that in other reports.[3] There was no influence of the surgical approach on postoperative mortality. Although a complication with need for re-operation was considered in some reports to be a bad prognostic sign with regard to survival,[3] this was not the case in the present study. Postoperative development of AMI, however, proved to be a bad prognostic sign because one out of three patients who developed AMI died postoperatively.

Table 5. Complications according to operative approach in 423 nephrectomies

	Retroperitoneal (n = 303)	Transabdominal (n = 116)	p value
Postoperative complications (%)	10.6	12.1	NS
Re-operations (%)	3.0	3.4	NS
Postoperative mortality (%)	0.7	0.9	NS

NS = not significant.

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